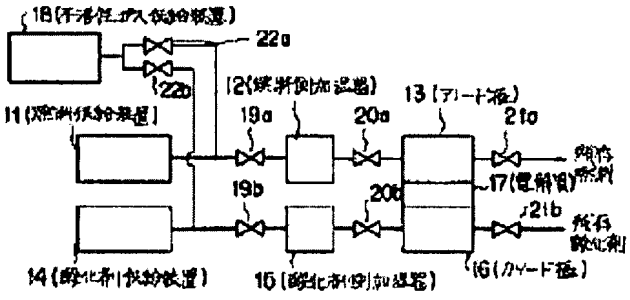
STOPPING AND STORING METHOD FOR SOLID POLYMER ELECTROLYTE FUEL CELL

Publication number: JP6251788
Publication date: 1994-09-09
Inventor: HASHIZAKI KATSUO
Applicant: MITSUBISHI HEAVY IND LTD
Classification:
- International: ***H01M8/04; H01M8/10;*** **H01M8/04; H01M8/10;** (IPC1-7): H01M8/04; H01M8/10
- European: H01M8/04C2F
Application number: JP19930036336 19930225
Priority number(s): JP19930036336 19930225

Abstract of **JP6251788**

PURPOSE:To start power generation speedily after fuel and an oxidating agent are introduced when operation is restarted, and reduce a quantity of inactive gas to be used by stopping the operation in a condition where water or the humidified inert gas is sealed up in a fuel gas passage or an oxidating agent gas passage of a fuel cell body.
CONSTITUTION:When operation is stopped, supply of fuel from a fuel supply device 11 is stopped, and a gate valve 22a is opened instead, and an inert gas is supplied to a fuel humidifier 12 from an inactive gas supply device 18, and the inactive gas humidified here is supplied to an anode pole 13, and residual fuel A of the anode pole is substituted with the inert gas while purging it. Supply of an oxidating agent from an oxidating agent supply device 14 is stopped, and a gate valve 22b is opened instead, and the inert gas is supplied to an oxidating agent side humidifier 15 from the inert gas supply device 18, and the inactive gas humidified here is supplied to a cathode pole 16, and a residual oxidating agent B of the cathode pole 16 is substituted with the inactive gas while purging it.



JAPANESE [JP,06-251788,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS CORRECTION OR AMENDMENT

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The halt storage approach of the solid-state polyelectrolyte fuel cell characterized by suspending and keeping operation where the condition which enclosed water with the fuel gas passage or oxidant gas passage of a cell proper, or the humidified inert gas is enclosed in the halt storage approach of a solid-state polyelectrolyte fuel cell.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the storage approach at the time of the shutdown of a solid-state polyelectrolyte fuel cell.
[0002]
[Description of the Prior Art] The general generation-of-electrical-energy principle of a solid-state polyelectrolyte fuel cell is explained below with reference to drawing 3 .
[0003] The solid-state polyelectrolyte fuel cell has structure equipped with the cell proper 6 which consists of an electrolyte 1 which consists of macromolecule ion exchange membrane like the fluororesin system ion exchange membrane which has a sulfonic group as shown in drawing 3 , and the catalyst electrodes 2 and 3 which consist of platinum, for example and the porosity carbon electrodes 4 and 5 arranged by carrying out a laminating to the both sides of said electrolyte 1, respectively.
[0004] In the fuel cell of such structure, the hydrogen in the fuel supplied to the anode pole side is hydrogen-ion-ized on said catalyst electrode (anode pole) 2, as shown in the following formula (1), and a hydrogen ion moves to the cathode pole 3 side as H+ and xH2 O also as that of mediation of the water in said electrolyte 1. On the catalyst electrode (cathode pole) 3, as shown in the following type (2), it reacts with the electron which has flowed the oxygen and the external circuit 7 in an oxidizer, and water is generated, and it is discharged by the fuel cell exterior. At this time, the flow of the electron which flows an external circuit 7 is used as electrical energy of a direct current.
(Anode side) H2 ->2H++2e- -- (1)
(Cathode side) 1/2 O2+2H++2e-->H2 O -- (2)
(Overall reaction) H2+1 / 2 O2 ->H2 O [0005] In order to have ionic permeability which the ion exchange membrane used as said electrolyte 1 mentioned above, it is required to always fully maintain a water retention condition for the film. For this reason, a fuel or an oxidizer is conventionally humidified and supplied to said fuel cell. A fuel cell performs purge processing by the inert gas which dried the anode pole and cathode pole side in the case of shutdown, and since halt storage is carried out, ion exchange membrane once returns to dryness. Therefore, at the time of a reboot, the fuel cell returned ion exchange membrane to the water

retention condition again with the humidified inert gas, supplied the fuel and the oxidizer after that, and had adopted the technique of starting a re-generation of electrical energy.
[0006]
[Problem(s) to be Solved by the Invention] By a halt of the conventional solid-state polyelectrolyte fuel cell and the storage approach, in order to carry out the supplied air of the inert gas humidified at the time of (2) reboots by which ion exchange membrane is again spent on time amount by the water retention condition by ** with the inert gas humidified at the time of (1) reboot in order to once return to the condition that ion exchange membrane dried, there was a problem that the amount of inert gas which carries out part use increased.
[0007] The purpose of this invention tends to offer the halt storage approach of the solid-state polyelectrolyte fuel cell [it is possible to start a generation of electrical energy promptly by introducing a fuel and an oxidizer at the time of a reboot, and] which can decrease the amount of the inert gas used.
[0008]
[Means for Solving the Problem] This invention is characterized by suspending and keeping operation, where shutdown, the condition which enclosed water with the fuel gas passage or oxidant gas passage of a cell proper, or the humidified inert gas is enclosed for the ion exchange membrane which is the electrolyte of a solid-state polyelectrolyte fuel cell so that it may face keeping it and may not dry it.
[0009]
[Function] According to this invention, it becomes possible about said ion exchange membrane to purge a cell with a water retention condition by facing carrying out shutdown of the ion exchange membrane which is the electrolyte of a solid-state polyelectrolyte fuel cell, and circulating water or the humidified inert gas to fuel gas passage or oxidant gas passage. Moreover, it can be kept by enclosing water or the humidified inert gas as it is, changing said ion exchange membrane into a water retention condition till a reboot. Therefore, a generation of electrical energy can be promptly started by introducing a fuel and an oxidizer at the time of a reboot.
[0010]
[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.
Example 1 [0011] Drawing 1 is the schematic diagram showing the system of a solid-state polyelectrolyte fuel cell used for an example 1. The fuel supply system 11 is connected with the anode pole 13 through the fuel side humidifier 12. The oxidizer feeder 14 is connected with the cathode pole 16 through the oxidizer side humidifier 15. The electrolyte 17 which consists of ion exchange membrane intervenes between said anode pole 13 and the cathode pole 16. The inert gas feeder 18 is connected with piping between said fuel supply system 11, between said fuel side humidifiers 12 and said oxidizer feeder 14, and said oxidizer side humidifier 15 through piping, respectively.
[0012] The 1st two sluice valve 19a and 19b is infixed in piping of the downstream of said fuel supply system 11 and said oxidizer feeder 14, respectively. The 2nd two sluice valve 20a and 20b is infixed in piping of the downstream of said fuel side

humidifier 12 and the oxidizer side humidifier 15, respectively. The 3rd two sluice valve 21a and 21b is infixed in piping of the downstream of said anode pole 13 and said cathode pole 16, respectively. The 4th two sluice valve 22a and 22b is infixed in said said about 18 inert gas feeder piping, respectively. Next, with reference to the system of drawing 1 mentioned above, the halt storage approach of the solid-state polyelectrolyte fuel cell of an example 1 is explained.

[0013] First, the 4th sluice valve 22a and 22b is closed, and it generates electricity by supplying an oxidizer for a fuel through the oxidizer feeder 14 to the oxidizer side humidifier 15 on said anode pole 13 at the cathode pole 16 through a fuel supply system 11 to the fuel side humidifier 12, respectively.

[0014] It permutes by inert gas, suspending supply of the fuel from said fuel supply system 11 at the time of the shutdown of a fuel cell, opening said 4th sluice valve 22a instead, supplying the inert gas which supplied the fuel side humidifier 12 from the inert gas feeder 18, and was humidified in inert gas here to said anode pole 13, and purging the residual fuel of said anode pole 13. After ending a permutation, enclosure of the inert gas humidified by closing the 2nd and 3rd sluice valve 20a and 21a by the side of a fuel line, or closing the 1st and 3rd sluice valve 19a and 21a is completed.

[0015] Moreover, it permutes by inert gas, suspending supply of the oxidizer from said oxidizer feeder 14, opening said 4th sluice valve 22b instead, supplying the inert gas which supplied the oxidizer side humidifier 15 from the inert gas feeder 18, and was humidified in inert gas here to said cathode pole 16, and purging the residual oxidizer of said cathode pole 16. After ending a permutation, enclosure of the inert gas humidified by closing the 2nd and 3rd sluice valve 20b and 21b by the side of oxidizer piping, or closing the 1st and 3rd sluice valve 19b and 21b is completed.

[0016] Since a water retention condition was maintained according to such an example 1, without drying the ion exchange membrane of said electrolyte 17 by suspending and keeping operation where the inert gas humidified by fuel gas passage or oxidant gas passage is enclosed, the generation of electrical energy was able to be promptly started by introducing a fuel and an oxidizer, respectively from said fuel supply system 11 and said oxidizer feeder 14 at the time of a reboot.

Example 2 [0017] Drawing 2 is the schematic diagram showing the system of a solid-state polyelectrolyte fuel cell used for an example 2. The fuel supply system 31 is connected with the anode pole 33 through the fuel side humidifier 32. The oxidizer feeder 34 is connected with the cathode pole 36 through the oxidizer side humidifier 35. The electrolyte 37 which consists of ion exchange membrane intervenes between said anode pole 33 and the cathode pole 36. The water feeder 38 is connected with piping between said fuel side humidifier 32 and said anode pole 33 and between said oxidizer side humidifier 35 and said cathode pole 36 through piping, respectively.

[0018] The 1st two sluice valve 39a and 39b is infixed in piping of the downstream of said fuel supply system 31 and said oxidizer feeder 34, respectively. The 2nd two sluice valve 40a and 40b is infixed in piping of the downstream of said fuel side humidifier 32 and said oxidizer side humidifier 35, respectively. The 3rd two sluice valve 41a and 41b is infixed in piping of the upstream of said anode pole 33 and

said cathode pole 36, respectively. In addition, two piping which leads to said water feeder 38 will be connected with piping between said 2nd sluice valve 40a and 40b and 3rd sluice valve 41a and 41b, respectively. The 4th two sluice valve 42a and 42b is infixed in piping of the downstream of said anode pole 33 and said cathode pole 36, respectively. The 5th two sluice valve 43a and 43b is infixed in said said about 31 water feeder piping, respectively. Next, with reference to the system of drawing 2 mentioned above, the halt storage approach of the solid-state polyelectrolyte fuel cell of an example 2 is explained.

[0019] First, the 5th sluice valve 43a and 43b is closed, and it generates electricity by supplying an oxidizer for a fuel through the oxidizer feeder 34 to the oxidizer side humidifier 35 on said anode pole 33 at the cathode pole 36 through a fuel supply system 31 to the fuel side humidifier 32, respectively.

[0020] Supply of the fuel from said fuel supply system 31 is suspended at the time of the shutdown of a fuel cell, and 2nd sluice valve 40a is closed instead, and it permutes by water, opening said 5th sluice valve 43a, supplying water to said anode pole 33 from the water feeder 38, and purging the residual fuel of said anode pole 33. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 21a and 22a by the side of a fuel line, or closing the 3rd and 4th sluice valve 41a and 42a.

[0021] Moreover, supply of the oxidizer from said oxidizer feeder 34 is suspended, and 2nd sluice valve 40b is closed instead, and it permutes by water, opening 5th sluice valve 43b, supplying water to said cathode pole 36 from the water feeder 38, and purging the residual oxidizer of said cathode pole A 6. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 41b and 42b by the side of oxidizer piping.

[0022] Since a water retention condition was maintained according to such an example 2, without drying the ion exchange membrane of said electrolyte 37 by suspending and keeping operation where water is enclosed with fuel gas passage or oxidant gas passage, the generation of electrical energy was able to be promptly started by introducing a fuel and an oxidizer, respectively from said fuel supply system 31 and said oxidizer feeder 34 at the time of a reboot.

[0023] In addition, what is necessary is just to make the water feeder 44 shown in the broken line of drawing 2 provide with structure with which said fuel side humidifier 32 and said oxidizer side humidifier 35 are united in the cell proper in said example 2.

[0024]

[Effect of the Invention] [0025] which can start a generation of electrical energy promptly by introducing a fuel and an oxidizer at the time of the reboot of (1) fuel cell since the ion exchange membrane which is the electrolyte of the halt storage approach ****** solid-state polyelectrolyte fuel cell of the solid-state polyelectrolyte fuel cell concerning this invention is always maintainable in the water retention condition also at the time of shutdown and storage as explained in full detail above (2) ** which actuation of returning said ion exchange membrane to a water retention condition using the humidified inert gas at the time of a reboot can be excluded [**], and can decrease the amount of the inert gas used -- do remarkable effectiveness so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the storage approach at the time of the shutdown of a solid-state polyelectrolyte fuel cell.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] The general generation-of-electrical-energy principle of a solid-state polyelectrolyte fuel cell is explained below with reference to drawing 3 .
[0003] The solid-state polyelectrolyte fuel cell has structure equipped with the cell proper 6 which consists of an electrolyte 1 which consists of macromolecule ion exchange membrane like the fluororesin system ion exchange membrane which has a sulfonic group as shown in drawing 3 , and the catalyst electrodes 2 and 3 which consist of platinum, for example and the porosity carbon electrodes 4 and 5 arranged by carrying out a laminating to the both sides of said electrolyte 1, respectively.
[0004] In the fuel cell of such structure, the hydrogen in the fuel supplied to the anode pole side is hydrogen-ion-ized on said catalyst electrode (anode pole) 2, as shown in the following formula (1), and a hydrogen ion moves to the cathode pole 3 side as H+ and xH2 O also as that of mediation of the water in said electrolyte 1. On the catalyst electrode (cathode pole) 3, as shown in the following type (2), it reacts with the electron which has flowed the oxygen and the external circuit 7 in an oxidizer, and water is generated, and it is discharged by the fuel cell exterior. At this time, the flow of the electron which flows an external circuit 7 is used as electrical energy of a direct current.
(Anode side) H2 ->2H++2e- -- (1)
(Cathode side) 1/2 O2+2H++2e-->H2 O -- (2)
(Overall reaction) H2+1 / 2 O2 ->H2 O [0005] In order to have ionic permeability which the ion exchange membrane used as said electrolyte 1 mentioned above, it is required to always fully maintain a water retention condition for the film. For this reason, a fuel or an oxidizer is conventionally humidified and supplied to said fuel cell. A fuel cell performs purge processing by the inert gas which dried the anode pole and cathode pole side in the case of shutdown, and since halt storage is carried out, ion exchange membrane once returns to dryness. Therefore, at the time of a reboot, the fuel cell returned ion exchange membrane to the water retention condition again with the humidified inert gas, supplied the fuel and the oxidizer after that, and had adopted the technique of starting a re-generation of electrical energy.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] [0025] which can start a generation of electrical energy promptly by introducing a fuel and an oxidizer at the time of the reboot of (1) fuel cell since the ion exchange membrane which is the electrolyte of the halt storage approach ****** solid-state polyelectrolyte fuel cell of the solid-state polyelectrolyte fuel cell concerning this invention is always maintainable in the water retention condition also at the time of shutdown and storage as explained in full detail above (2) ** which actuation of returning said ion exchange membrane to a water retention condition using the humidified inert gas at the time of a reboot can be excluded [**], and can decrease the amount of the inert gas used -- do remarkable effectiveness so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By a halt of the conventional solid-state polyelectrolyte fuel cell and the storage approach, in order to carry out the supplied air of the inert gas humidified at the time of (2) reboots by which ion exchange membrane is again spent on time amount by the water retention condition by ** with the inert gas humidified at the time of (1) reboot in order to once return to the condition that ion exchange membrane dried, there was a problem that the amount of inert gas which carries out part use increased.
[0007] The purpose of this invention tends to offer the halt storage approach of the solid-state polyelectrolyte fuel cell [it is possible to start a generation of electrical energy promptly by introducing a fuel and an oxidizer at the time of a reboot, and] which can decrease the amount of the inert gas used.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] This invention is characterized by suspending and keeping operation, where shutdown, the condition which enclosed water with the fuel gas passage or oxidant gas passage of a cell proper, or the humidified inert gas is enclosed for the ion exchange membrane which is the electrolyte of a solid-state polyelectrolyte fuel cell so that it may face keeping it and may not dry it.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

OPERATION

[Function] According to this invention, it becomes possible about said ion exchange membrane to purge a cell with a water retention condition by facing carrying out shutdown of the ion exchange membrane which is the electrolyte of a solid-state polyelectrolyte fuel cell, and circulating water or the humidified inert gas to fuel gas passage or oxidant gas passage. Moreover, it can be kept by enclosing water or the humidified inert gas as it is, changing said ion exchange membrane into a water retention condition till a reboot. Therefore, a generation of electrical energy can be promptly started by introducing a fuel and an oxidizer at the time of a reboot.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.
Example 1 [0011] Drawing 1 is the schematic diagram showing the system of a solid-state polyelectrolyte fuel cell used for an example 1. The fuel supply system 11 is connected with the anode pole 13 through the fuel side humidifier 12. The oxidizer feeder 14 is connected with the cathode pole 16 through the oxidizer side humidifier 15. The electrolyte 17 which consists of ion exchange membrane intervenes between said anode pole 13 and the cathode pole 16. The inert gas feeder 18 is connected with piping between said fuel supply system 11, between said fuel side humidifiers 12 and said oxidizer feeder 14, and said oxidizer side humidifier 15 through piping, respectively.
[0012] The 1st two sluice valve 19a and 19b is infixed in piping of the downstream of said fuel supply system 11 and said oxidizer feeder 14, respectively. The 2nd two sluice valve 20a and 20b is infixed in piping of the downstream of said fuel side humidifier 12 and the oxidizer side humidifier 15, respectively. The 3rd two sluice valve 21a and 21b is infixed in piping of the downstream of said anode pole 13 and said cathode pole 16, respectively. The 4th two sluice valve 22a and 22b is infixed in said said about 18 inert gas feeder piping, respectively. Next, with reference to the system of drawing 1 mentioned above, the halt storage approach of the solid-state polyelectrolyte fuel cell of an example 1 is explained.
[0013] First, the 4th sluice valve 22a and 22b is closed, and it generates electricity by supplying an oxidizer for a fuel through the oxidizer feeder 14 to the oxidizer side humidifier 15 on said anode pole 13 at the cathode pole 16 through a fuel supply system 11 to the fuel side humidifier 12, respectively.
[0014] It permutes by inert gas, suspending supply of the fuel from said fuel supply system 11 at the time of the shutdown of a fuel cell, opening said 4th sluice valve 22a instead, supplying the inert gas which supplied the fuel side humidifier 12 from the inert gas feeder 18, and was humidified in inert gas here to said anode pole 13, and purging the residual fuel of said anode pole 13. After ending a permutation, enclosure of the inert gas humidified by closing the 2nd and 3rd sluice valve 20a and 21a by the side of a fuel line, or closing the 1st and 3rd sluice valve 19a and 21a is completed.
[0015] Moreover, it permutes by inert gas, suspending supply of the oxidizer from said oxidizer feeder 14, opening said 4th sluice valve 22b instead, supplying the

inert gas which supplied the oxidizer side humidifier 15 from the inert gas feeder 18, and was humidified in inert gas here to said cathode pole 16, and purging the residual oxidizer of said cathode pole 16. After ending a permutation, enclosure of the inert gas humidified by closing the 2nd and 3rd sluice valve 20b and 21b by the side of oxidizer piping, or closing the 1st and 3rd sluice valve 19b and 21b is completed.

[0016] Since a water retention condition was maintained according to such an example 1, without drying the ion exchange membrane of said electrolyte 17 by suspending and keeping operation where the inert gas humidified by fuel gas passage or oxidant gas passage is enclosed, the generation of electrical energy was able to be promptly started by introducing a fuel and an oxidizer, respectively from said fuel supply system 11 and said oxidizer feeder 14 at the time of a reboot.

Example 2 [0017] Drawing 2 is the schematic diagram showing the system of a solid-state polyelectrolyte fuel cell used for an example 2. The fuel supply system 31 is connected with the anode pole 33 through the fuel side humidifier 32. The oxidizer feeder 34 is connected with the cathode pole 36 through the oxidizer side humidifier 35. The electrolyte 37 which consists of ion exchange membrane intervenes between said anode pole 33 and the cathode pole 36. The water feeder 38 is connected with piping between said fuel side humidifier 32 and said anode pole 33 and between said oxidizer side humidifier 35 and said cathode pole 36 through piping, respectively.

[0018] The 1st two sluice valve 39a and 39b is infixed in piping of the downstream of said fuel supply system 31 and said oxidizer feeder 34, respectively. The 2nd two sluice valve 40a and 40b is infixed in piping of the downstream of said fuel side humidifier 32 and said oxidizer side humidifier 35, respectively. The 3rd two sluice valve 41a and 41b is infixed in piping of the upstream of said anode pole 33 and said cathode pole 36, respectively. In addition, two piping which leads to said water feeder 38 will be connected with piping between said 2nd sluice valve 40a and 40b and 3rd sluice valve 41a and 41b, respectively. The 4th two sluice valve 42a and 42b is infixed in piping of the downstream of said anode pole 33 and said cathode pole 36, respectively. The 5th two sluice valve 43a and 43b is infixed in said said about 31 water feeder piping, respectively. Next, with reference to the system of drawing 2 mentioned above, the halt storage approach of the solid-state polyelectrolyte fuel cell of an example 2 is explained.

[0019] First, the 5th sluice valve 43a and 43b is closed, and it generates electricity by supplying an oxidizer for a fuel through the oxidizer feeder 34 to the oxidizer side humidifier 35 on said anode pole 33 at the cathode pole 36 through a fuel supply system 31 to the fuel side humidifier 32, respectively.

[0020] Supply of the fuel from said fuel supply system 31 is suspended at the time of the shutdown of a fuel cell, and 2nd sluice valve 40a is closed instead, and it permutes by water, opening said 5th sluice valve 43a, supplying water to said anode pole 33 from the water feeder 38, and purging the residual fuel of said anode pole 33. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 21a and 22a by the side of a fuel line, or closing the 3rd and 4th sluice valve 41a and 42a.

[0021] Moreover, supply of the oxidizer from said oxidizer feeder 34 is suspended,

and 2nd sluice valve 40b is closed instead, and it permutes by water, opening 5th sluice valve 43b, supplying water to said cathode pole 36 from the water feeder 38, and purging the residual oxidizer of said cathode pole A 6. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 41b and 42b by the side of oxidizer piping.

[0022] Since a water retention condition was maintained according to such an example 2, without drying the ion exchange membrane of said electrolyte 37 by suspending and keeping operation where water is enclosed with fuel gas passage or oxidant gas passage, the generation of electrical energy was able to be promptly started by introducing a fuel and an oxidizer, respectively from said fuel supply system 31 and said oxidizer feeder 34 at the time of a reboot.

[0023] In addition, what is necessary is just to make the water feeder 44 shown in the broken line of drawing 2 provide with structure with which said fuel side humidifier 32 and said oxidizer side humidifier 35 are united in the cell proper in said example 2.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The schematic diagram showing the system of the solid-state polyelectrolyte fuel cell in the example 1 of this invention.
[Drawing 2] The schematic diagram showing the system of the solid-state polyelectrolyte fuel cell in the example 2 of this invention.
[Drawing 3] The schematic diagram showing the generation-of-electrical-energy principle of a solid-state polyelectrolyte fuel cell.
[Description of Notations]
11 31 [-- 16 An oxidizer feeder, 36 / -- 17 A cathode pole, 37 / -- An electrolyte, 18 / -- An inert gas feeder, 38 / -- Water feeder.] -- A fuel supply system, 12, 15, 32, 35 -- 13 A humidifier, 33 -- 14 An anode pole, 34

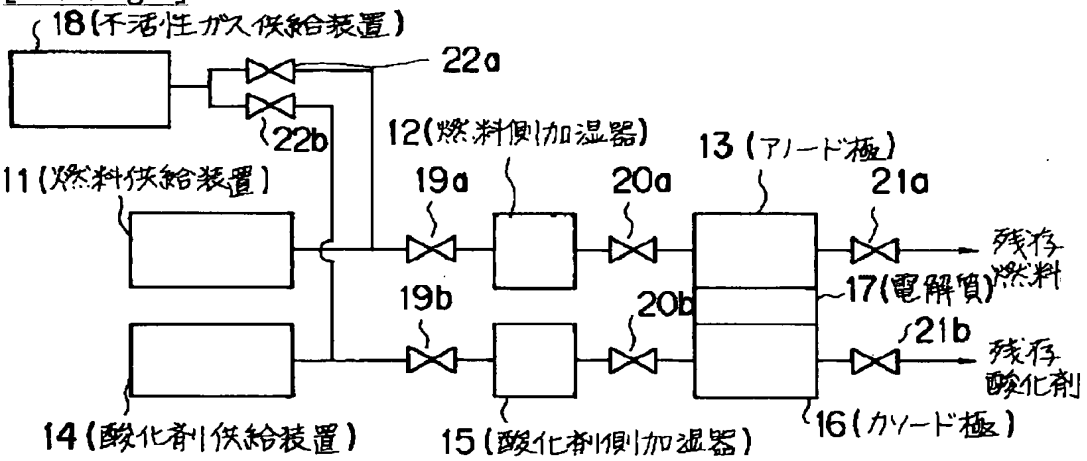
[Translation done.]

* NOTICES *

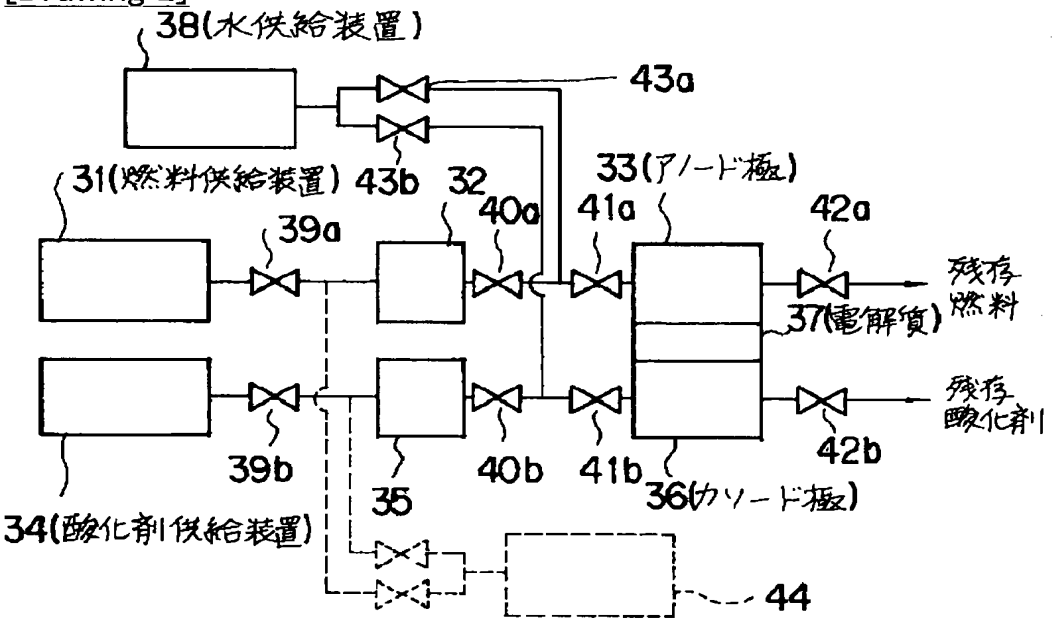
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

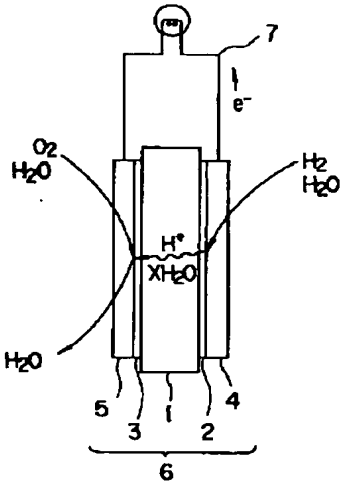
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 1st partition of the 7th section
[Publication date] December 24, Heisei 11 (1999)

[Publication No.] Publication number 6-251788
[Date of Publication] September 9, Heisei 6 (1994)
[Annual volume number] Open patent official report 6-2518
[Application number] Japanese Patent Application No. 5-36336
[International Patent Classification (6th Edition)]

H01M 8/04
8/10

[FI]

H01M 8/04 S
8/10

[Procedure revision]
[Filing Date] April 28, Heisei 11
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] 0020
[Method of Amendment] Modification
[Proposed Amendment]
[0020] Supply of the fuel from said fuel supply system 31 is suspended at the time of the shutdown of a fuel cell, and 2nd sluice valve 40a is closed instead, and it permutes by water, opening said 5th sluice valve 43a, supplying water to said anode pole 33 from the water feeder 38, and purging the residual fuel of said anode pole 33. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 41a and 42a by the side of a fuel line.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0021

[Method of Amendment] Modification
[Proposed Amendment]
[0021] Moreover, supply of the oxidizer from said oxidizer feeder 34 is suspended, and 2nd sluice valve 40b is closed instead, and it permutes by water, opening 5th sluice valve 43b, supplying water to said cathode pole 36 from the water feeder 38, and purging the residual oxidizer of said cathode pole 36. After ending a permutation, enclosure of water is completed by closing the 3rd and 4th sluice valve 41b and 42b by the side of oxidizer piping.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報（Ａ）**　(11)特許出願公開番号

特開平6－251788

(43)公開日　平成6年(1994)9月9日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｈ０１Ｍ	8/04	Ｓ			
	8/10		8821－4Ｋ		

審査請求　未請求　請求項の数1　ＯＬ　（全 5 頁）

(21)出願番号　特願平5－36336

(22)出願日　平成5年(1993)2月25日

(71)出願人　000006208
三菱重工業株式会社
東京都千代田区丸の内二丁目5番1号

(72)発明者　橋崎　克雄
東京都千代田区丸の内二丁目5番1号　三菱重工業株式会社内

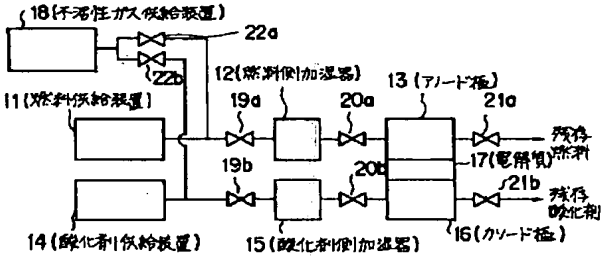
(74)代理人　弁理士　鈴江　武彦

(54)【発明の名称】　固体高分子電解質燃料電池の停止保管方法

(57)【要約】

【目的】　再起動時に燃料および酸化剤を導入することで速やかに発電を開始することが可能で、不活性ガス使用量を減少させることが可能な固体高分子電解質燃料電池の停止保管方法を提供しようとするものである。

【構成】　固体高分子電解質燃料電池の停止保管方法において、電池本体の燃料ガス流路または酸化剤ガス流路に水を封入した状態もしくは加湿された不活性ガスを封入した状態で運転を停止し、保管することを特徴としている。



【特許請求の範囲】

【請求項１】　固体高分子電解質燃料電池の停止保管方法において、電池本体の燃料ガス流路または酸化剤ガス流路に水を封入した状態もしくは加湿された不活性ガスを封入した状態で運転を停止し、保管することを特徴とする固体高分子電解質燃料電池の停止保管方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、固体高分子電解質燃料電池の運転停止時における保管方法に関するものである。

【０００２】

【従来の技術】固体高分子電解質燃料電池の一般的な発電原理を図３を参照して以下に説明する。

【０００３】固体高分子電解質燃料電池は、図３に示すように例えばスルホン酸基を持つフッ素樹脂系イオン交換膜のような高分子イオン交換膜からなる電解質１と、前記電解質１の両側にそれぞれ積層して配置された例えば白金からなる触媒電極２、３および多孔質カーボン電極４、５とからなる電池本体６を備えた構造になっている。

【０００４】このような構造の燃料電池において、アノード極側に供給された燃料中の水素は、下記式（１）に示すように前記触媒電極（アノード極）２上で水素イオン化され、水素イオンは前記電解質１中の水の介在のもと$H^+ \cdot xH_2O$としてカソード極３側へ移動する。触媒電極（カソード極）３上では、下記式（２）に示すように酸化剤中の酸素および外部回路７を流れてきた電子と反応して水を生成し、燃料電池外部に排出される。この時、外部回路７を流れる電子の流れを直流の電気エネルギーとして利用する。

（アノード側）　$H_2 \rightarrow 2H^+ + 2e^-$　…（１）

（カソード側）　$1/2\ O_2 + 2H^+ + 2e^- \rightarrow H_2O$…（２）

（全反応）　$H_2 + 1/2\ O_2 \rightarrow H_2O$

【０００５】前記電解質１となるイオン交換膜が前述したようなイオン透過性を有するためには、その膜を常に十分に保水状態を維持しておくことが必要である。このため、従来、前記燃料電池に燃料または酸化剤は加湿して供給される。燃料電池は、運転停止の際、アノード極側、カソード極側とも乾燥した不活性ガスによるパージ処理を施し、停止保管されるため、イオン交換膜は一旦乾燥状態に戻る。したがって、燃料電池は再起動の際、加湿された不活性ガス等により再度保水状態にイオン交換膜を戻し、その後燃料および酸化剤を供給し、再発電を開始する手法を採用していた。

【０００６】

【発明が解決しようとする課題】従来の固体高分子電解質燃料電池の停止、保管方法では、一旦、イオン交換膜が乾燥した状態に戻るため、（１）再起動時に加湿された不活性ガス等により再度、イオン交換膜を保水状態に戻までに時間が費やされる、（２）再起動時に加湿された不活性ガス等を送気するため、その分使用する不活性ガス量が増加する、という問題があった。

【０００７】本発明の目的は、再起動時に燃料および酸化剤を導入することで速やかに発電を開始することが可能で、不活性ガス使用量を減少させることが可能な固体高分子電解質燃料電池の停止保管方法を提供しようとするものである。

【０００８】

【課題を解決するための手段】本発明は、固体高分子電解質燃料電池の電解質であるイオン交換膜を運転停止、保管するに際して乾燥させないように、電池本体の燃料ガス流路または酸化剤ガス流路に水を封入した状態もしくは加湿された不活性ガスを封入した状態で運転を停止し、保管することを特徴とするものである。

【０００９】

【作用】本発明によれば、固体高分子電解質燃料電池の電解質であるイオン交換膜を運転停止するに際し、水もしくは加湿された不活性ガスを燃料ガス流路または酸化剤ガス流路に流通させることによって、前記イオン交換膜を保水状態のままで電池をパージすることが可能になる。また、水もしくは加湿された不活性ガスをそのまま封入することによって、再起動時まで前記イオン交換膜を保水状態にしたまま保管することができる。したがって、再起動時、燃料および酸化剤を導入することにより速やかに発電を開始することができる。

【００１０】

【実施例】以下、本発明の実施例を図面を参照して詳細に説明する。

実施例１

【００１１】図１は、実施例１に用いられる固体高分子電解質燃料電池のシステムを示す概略図である。燃料供給装置１１は、燃料側加湿器１２を通してアノード極１３に連結されている。酸化剤供給装置１４は、酸化剤側加湿器１５を通してカソード極１６に連結されている。イオン交換膜からなる電解質１７は、前記アノード極１３およびカソード極１６の間に介在されている。不活性ガス供給装置１８は、前記燃料供給装置１１と前記燃料側加湿器１２の間、前記酸化剤供給装置１４と前記酸化剤側加湿器１５の間の配管にそれぞれ配管を介して連結されている。

【００１２】２つの第１仕切弁１９ａ、１９ｂは、前記燃料供給装置１１および前記酸化剤供給装置１４の下流側の配管にそれぞれ介装されている。２つの第２仕切弁２０ａ、２０ｂは、前記燃料側加湿器１２および酸化剤側加湿器１５の下流側の配管にそれぞれ介装されてい

る。２つの第３仕切弁２１ａ、２１ｂは、前記アノード極１３および前記カソード極１６の下流側の配管にそれぞれ介装されている。２つの第４仕切弁２２ａ、２２ｂは、前記不活性ガス供給装置１８近傍の前記配管にそれぞれ介装されている。次に、前述した図１のシステムを参照して実施例１の固体高分子電解質燃料電池の停止保管方法を説明する。

【００１３】まず、第４の仕切弁２２ａ、２２ｂを閉じ、燃料を燃料供給装置１１から燃料側加湿器１２を通して前記アノード極１３に、酸化剤を酸化剤供給装置１４から酸化剤側加湿器１５を通してカソード極１６にそれぞれ供給することにより発電を行う。

【００１４】燃料電池の運転停止時においては、前記燃料供給装置１１からの燃料の供給を停止し、代わりに前記第４の仕切弁２２ａを開けて不活性ガスを不活性ガス供給装置１８から燃料側加湿器１２を供給し、ここで加湿された不活性ガスを前記アノード極１３に供給して前記アノード極１３の残存燃料をパージしながら不活性ガスに置換する。置換を終了した後、燃料配管側の第２、第３の仕切弁２０ａ、２１ａを閉じるか、または第１、第３の仕切弁１９ａ、２１ａを閉じることにより加湿された不活性ガスの封入を完了する。

【００１５】また、前記酸化剤供給装置１４からの酸化剤の供給を停止し、代わりに前記第４の仕切弁２２ｂを開けて不活性ガスを不活性ガス供給装置１８から酸化剤側加湿器１５を供給し、ここで加湿された不活性ガスを前記カソード極１６に供給して前記カソード極１６の残存酸化剤をパージしながら不活性ガスに置換する。置換を終了した後、酸化剤配管側の第２、第３の仕切弁２０ｂ、２１ｂを閉じるか、または第１、第３の仕切弁１９ｂ、２１ｂを閉じることにより加湿された不活性ガスの封入を完了する。

【００１６】このような実施例１によれば、燃料ガス流路または酸化剤ガス流路に加湿された不活性ガスを封入した状態で運転を停止し、保管することによって前記電解質１７のイオン交換膜を乾燥させずに保水状態を維持できるため、再起動時、前記燃料供給装置１１および前記酸化剤供給装置１４からそれぞれ燃料および酸化剤を導入することにより速やかに発電を開始することができた。実施例２

【００１７】図２は、実施例２に用いられる固体高分子電解質燃料電池のシステムを示す概略図である。燃料供給装置３１は、燃料側加湿器３２を通してアノード極３３に連結されている。酸化剤供給装置３４は、酸化剤側加湿器３５を通してカソード極３６に連結されている。イオン交換膜からなる電解質３７は、前記アノード極３３およびカソード極３６の間に介在されている。水供給装置３８は、前記燃料側加湿器３２と前記アノード極３３の間、および前記酸化剤側加湿器３５と前記カソード極３６の間の配管にそれぞれ配管を介して連結されている。

【００１８】２つの第１仕切弁３９ａ、３９ｂは、前記燃料供給装置３１および前記酸化剤供給装置３４の下流側の配管にそれぞれ介装されている。２つの第２仕切弁４０ａ、４０ｂは、前記燃料側加湿器３２および前記酸化剤側加湿器３５の下流側の配管にそれぞれ介装されている。２つの第３仕切弁４１ａ、４１ｂは、前記アノード極３３および前記カソード極３６の上流側の配管にそれぞれ介装されている。なお、前記水供給装置３８に繋がる２つの配管は前記第２の仕切弁４０ａ、４０ｂと第３の仕切弁４１ａ、４１ｂの間の配管にそれぞれ連結されることになる。２つの第４仕切弁４２ａ、４２ｂは、前記アノード極３３および前記カソード極３６の下流側の配管にそれぞれ介装されている。２つの第５仕切弁４３ａ、４３ｂは、前記水供給装置３１近傍の前記配管にそれぞれ介装されている。次に、前述した図２のシステムを参照して実施例２の固体高分子電解質燃料電池の停止保管方法を説明する。

【００１９】まず、第５の仕切弁４３ａ、４３ｂを閉じ、燃料を燃料供給装置３１から燃料側加湿器３２を通して前記アノード極３３に、酸化剤を酸化剤供給装置３４から酸化剤側加湿器３５を通してカソード極３６にそれぞれ供給することにより発電を行う。

【００２０】燃料電池の運転停止時においては、前記燃料供給装置３１からの燃料の供給を停止し、代わりに第２の仕切弁４０ａを閉じ、前記第５の仕切弁４３ａを開けて水を水供給装置３８から前記アノード極３３に供給して前記アノード極３３の残存燃料をパージしながら水に置換する。置換を終了した後、燃料配管側の第３、第４の仕切弁２１ａ、２２ａを閉じるか、または第３、第４の仕切弁４１ａ、４２ａを閉じることにより水の封入を完了する。

【００２１】また、前記酸化剤供給装置３４からの酸化剤の供給を停止し、代わりに第２の仕切弁４０ｂを閉じ、第５の仕切弁４３ｂを開けて水を水供給装置３８から前記カソード極３６に供給して前記カソード極ア６の残存酸化剤をパージしながら氷に置換する。置換を終了した後、酸化剤配管側の第３、第４の仕切弁４１ｂ、４２ｂを閉じることにより水の封入を完了する。

【００２２】このような実施例２によれば、燃料ガス流路または酸化剤ガス流路に水を封入した状態で運転を停止し、保管することによって前記電解質３７のイオン交換膜を乾燥させずに保水状態を維持できるため、再起動時、前記燃料供給装置３１および前記酸化剤供給装置３４からそれぞれ燃料および酸化剤を導入することにより速やかに発電を開始することができた。

【００２３】なお、前記実施例２において前記燃料側加湿器３２および前記酸化剤側加湿器３５が電池本体に一体になっているような構造では、図２の破線に示す水供給装置４４を具備させればよい。

【００２４】

【発明の効果】以上詳述したように、本発明に係わる固体高分子電解質燃料電池の停止保管方法よれば固体高分子電解質燃料電池の電解質であるイオン交換膜を運転停止、保管時も常に保水状態に維持することができるため、（１）燃料電池の再起動時に燃料および酸化剤を導入することで速やかに発電を開始することができる、

【００２５】（２）再起動時、加湿された不活性ガス等を用いて前記イオン交換膜を保水状態に戻す操作を省くことができ、不活性ガスの使用量を減少させることができる、等顕著な効果を奏する。

【図面の簡単な説明】

【図１】本発明の実施例１における固体高分子電解質燃料電池のシステムを示す概略図。

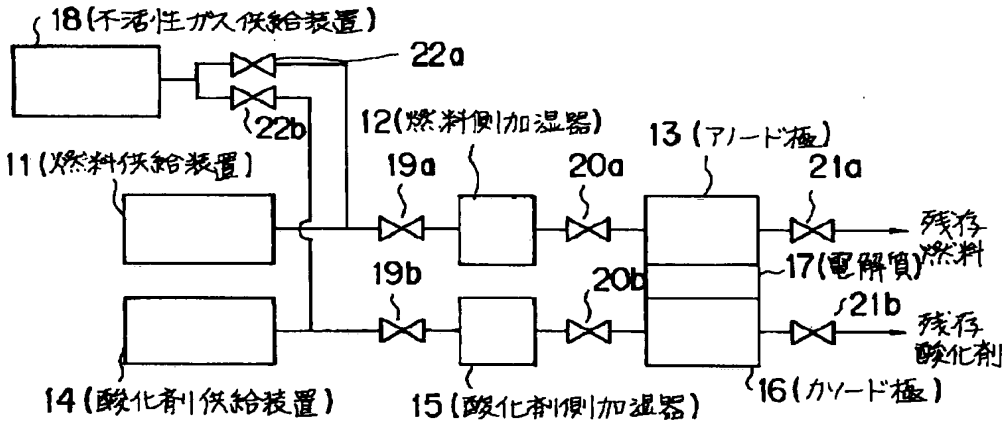
【図２】本発明の実施例２における固体高分子電解質燃料電池のシステムを示す概略図。

【図３】固体高分子電解質燃料電池の発電原理を示す概略図。

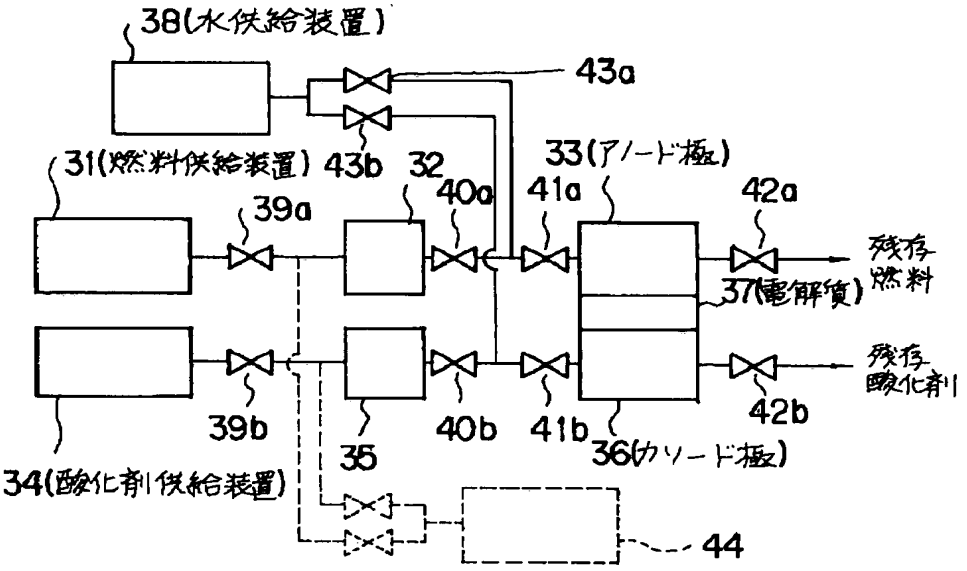
【符号の説明】

１１、３１…燃料供給装置、１２、１５、３２、３５…加湿器、１３、３３…アノード極、１４、３４…酸化剤供給装置、１６、３６…カソード極、１７、３７…電解質、１８…不活性ガス供給装置、３８…水供給装置。

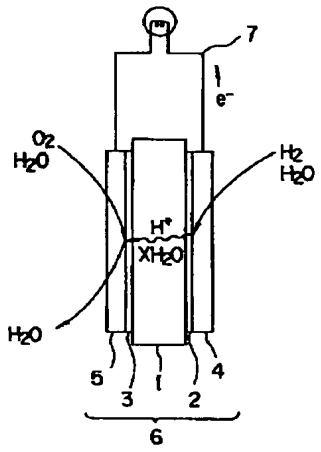
【図１】



【図２】



【図３】



【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第７部門第１区分
【発行日】平成１１年（１９９９）１２月２４日

【公開番号】特開平６—２５１７８８
【公開日】平成６年（１９９４）９月９日
【年通号数】公開特許公報６—２５１８
【出願番号】特願平５—３６３３６
【国際特許分類第６版】
H01M　8/04
　　8/10
【ＦＩ】
H01M　8/04　　S
　　8/10

【手続補正書】
【提出日】平成１１年４月２８日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００２０
【補正方法】変更
【補正内容】
【００２０】燃料電池の運転停止時においては、前記燃料供給装置３１からの燃料の供給を停止し、代わりに第２の仕切弁４０ａを閉じ、前記第５の仕切弁４３ａを開けて水を水供給装置３８から前記アノード極３３に供給して前記アノード極３３の残存燃料をパージしながら水に置換する。置換を終了した後、燃料配管側の第３、第４の仕切弁４１ａ、４２ａを閉じることにより水の封入を完了する。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００２１
【補正方法】変更
【補正内容】
【００２１】また、前記酸化剤供給装置３４からの酸化剤の供給を停止し、代わりに第２の仕切弁４０ｂを閉じ、第５の仕切弁４３ｂを開けて水を水供給装置３８から前記カソード極３６に供給して前記カソード極３６の残存酸化剤をパージしながら水に置換する。置換を終了した後、酸化剤配管側の第３、第４の仕切弁４１ｂ、４２ｂを閉じることにより水の封入を完了する。